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ABSTRACT

The teaching techniques presented in this booklet are designed to provide students with concepts which relate to the energy crisis and energy conservation. The techniques are not presented in the form of completed lesson plans, but rather are intended to act as starting points for further development by the teacher. General activities for students are suggested for the topics of conservation of energy; production of electricity and heat; social impact, political implications, economics, and geography of the energy crisis; and energy in transportation, in the home, in the school, and in the community. Twenty-two projects related to the energy crisis and energy conservation also are suggested. Tips on how to conserve energy and several diagrams concerning energy topics are provided. (DT)

ENERGY, KEY to the FUTURE

Teaching Techniques for the Understanding and Conservation of Energy

K 12

Dutchess County Board of Cooperative Educational Services
1 Salt Point Turnpike Poughkeepsie New York 12601

ENERGY, KEY to the FUTURE

Dutchess County
Board of Cooperative
Educational Services

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INTRODUCTION

The world now finds itself in the middle of an energy crisis. This crisis is so basic as to affect every aspect of our economic, social and political lives. Our life styles are changing as we watch less television, drive our cars less and feel cooler temperatures in our homes. Economically, we find the price of commodities such as fuel oil and gasoline spiraling upward as supplies dwindle. There are shortages of many consumer goods such as plastics and polyester fabrics, we had not previously thought of as related to the production of oil. Politically, our local, state and national governments have been forced to realign their policies as a result of pressures brought on by the energy crisis.

As educators, it becomes our responsibility to instruct pupils in ways energy affects them and how they can effectively deal with this crisis. There are several components of the concept of energy.

1. Energy is so basic that nothing moves without it.

2. Energy is a fixed commodity being neither created nor destroyed, but converted from one form to another. The means of conversion and the by-products of this conversion are important.

3. Presently, most of our energy requirements are met through fossil fuels. However, there are other alternative sources of energy such as solar, wind, fission, fusion, hydrogen, hydro and geothermal which must be explored.

4. Energy, its use and conservation are essential in the maintenance of our society as we know it.

SUGGESTED PROCEDURE FOR PROPER UTILIZATION OF THIS ENERGY GUIDE

The teaching techniques presented in this booklet are designed to provide students with concepts which relate to the energy crisis and energy conservation. The techniques are not presented in the form of completed lesson plans. Rather, they are ideas that act as starting points for further development by the teacher. It is expected that the teacher will select and develop those techniques which best meet the needs and ability of the student. For example, the first objective on page one states:

1. Demonstrate the conversion of energy through the use of the windmill or the water wheel. Demonstrate how the energy of the wind or water can be converted to mechanical energy to accomplish work.

This objective can be implemented at all grade levels. Some possibilities follow:

K-3 1. Each student will construct a paper pinwheel and will observe the energy of the moving air.

2. The student will observe that the faster the air moves, the faster the pinwheel turns. Therefore, more energy is present.

3. The student will observe that the pinwheel turns faster when facing directly into the force of the moving air.

4-6 1. The student will redesign the pinwheel to catch more air, and, therefore, become more efficient.

2. The student will attach a rudder to the pinwheel and mount it on a base which will allow the pinwheel to rotate and to stay perpendicular to the force of moving air.

3. The student will connect a spool and string with a button tied to the end to the axle of the pinwheel. The moving air will turn the spool and wind up the string and button. This demonstrates the conversion of the energy of moving air to the mechanical energy required to lift the button. The size of the spool can be changed to demonstrate the concept of mechanical advantage.

7-9 1. The student will construct a working model windmill using designs they have developed after research.

2. A contest will be held to see who can construct the 'best' windmill based on efficiency.

3. The student will explore motion; the concepts of Newton through observation, data, collection and analyzation.

4. The student will explore the concept of torque and horsepower through the scientific method.

5. The student will develop different devices to convert the circular motion of the windmill into mechanical energy to accomplish some kind of work. (*Examples:* a generator to produce electricity, a pump to move water, a grindstone to produce flour, a saw to cut wood.)

10-12

1. The student will build an operational windmill which they have designed based on their research.

2. The student will monitor and record the energy output of the windmill

3. The student will study the energy needs of the school.

4. The student will develop and implement a program to use the energy of the windmill to fill some energy need in the school.

In conclusion, this guide is not designed as an end unto itself, but merely a starting point. We would greatly appreciate additional information from you concerning projects you are doing with your classes or techniques used to implement this guide. Send pertinent information to Mr. Herbert Liberman, Director of Instructional Services, R.D. 1, Salt Point Turnpike, Poughkeepsie, New York 12601.

TEACHING TECHNIQUES RELATED TO THE CONVERSION OF ENERGY

Energy is neither created nor destroyed, but converted from one form to another. Thus, when we produce electricity, *we are not producing energy, but converting it from one form to another*. This conversion is accomplished through a 'conversion device'. This device involves: (1) the input of energy to be converted; (2) the conversion device itself, and (3) the energy output. Also related to the energy output are the by-products of side effects produced through the conversion of the energy. For example, the conversion of electricity to light energy produces the by-product of heat energy. The use or misuse of this energy is an important consideration.

1. Demonstrate the conversion of energy through the use of the windmill or the water wheel. Demonstrate how the energy of the wind or water is converted to mechanical energy to accomplish work.

2. Demonstrate how the burning of wood converts the energy stored in the wood into heat and light energy, the by-product being ashes or charcoal and smoke. Discuss stored energy (potential energy). List the kinds of stored energy and materials which contain stored energy. This would include nuclear energy in the form of fussion and fission. Other examples of items that contain stored energy are food, battery, etc.

3. Follow the conversion of energy through a diagram or wall mural. The energy originates from the sun, and is transmitted through decayed plants, which are converted into crude oil, which is converted into fuel oil, which is converted into heat used to boil water producing steam, which is converted into light energy in incandescent and flourescent lights. Be aware of the by-products along the way. What happens to these by-products, are they reused or allowed to become waste? Explore the concept that almost all energy, with the exception of nuclear energy, originates from the sun. Isolate different forms of energy and follow the flow of this energy backward and forward.

4. Trace the energy which man uses in his body back through the energy chain to the sun. What kinds of energy does man possess (heat, electrical, mechanical)? Discuss the conversion of food by the body into energy.

5. During visits to energy users (factories, utilities, etc.), note the side effects or by-products such as noise, smoke, odors and heat. Have students examine the by-products or side effects of energy conversion to determine if there is any conceivable value to this by-product.

6. What becomes of the unwanted by-products or side effects? What is the cost involved getting rid of these unwanted by-products? How and where are these unwanted by-products or side effects disposed of? Explore what is happening as a result of the disposition of these by-products.

TEACHING TECHNIQUES FOR THE PRODUCTION OF ELECTRICITY

1. Research the major sources of energy used to generate electricity. Make a chart or graph showing their proportional use (i.e., oil, coal, atomic energy, hydro and wind).

2. Visit an electricity generating plant to see how the fuel is turned into electricity. What are the by-products? How are they used? How is the electricity generated? How is the electricity stored?

3. Build or draw a diagram of an electric generator. Label all its parts and describe their use.

4. The telephone company uses electricity to operate its telephones. Where does it come from? How did it get there? How is it stored? Visit the telephone company and find out how the telephone works. How much electricity does it use? Are there any means of conserving energy as it relates to the telephone?

5. Build a telephone. Label all its parts and describe their use.

6. Draw a diagram of the stages of energy transfer and conversion from the human voice through the telephone system to the production of sound at the other end.

7. Atomic energy is used to produce electricity. Visit an atomic energy plant or have a representative speak to the class. Build a model or draw a diagram of an atomic power plant. What is the source of energy? Does it use other forms of fuel? What are they? How is it used to generate electricity? Trace the energy conversion present here. What are the by-products of this conversion device? How are they accommodated in the environment? What are the effects?

8. What are the chances for new sources of energy to generate electricity, (i.e., solar energy, the energy of the wind, geothermal energy)?

9. What is the future outlook for the consumption of energy as it relates to the production of electricity? Our country and the world requires more electricity. What will be the most economic and environmentally safe means of producing this electricity?

10. What is the difference between an incandescent and flourescent light? Use diagrams to show their operation. How much power does each use? Open a light bulb, examine its parts. (CAUTION: dust on the interior of the flouescent bulb is poisonous, keep away from contact with skin or eyes.)

TEACHING TECHNIQUES FOR THE PRODUCTION OF HEAT

1. Make a list or compile a set of pictures of the uses of heat in your home, school and community. How is the heat generated (conversion device) for each of these uses? What are the sources of energy used to produce heat for each of the categories mentioned above? How much energy is used for each? What does it cost?

2. Prepare and contrast the production of home heating systems (i.e., hot water, steam and hot air). How are they alike? How are they different? Which are more efficient? What is the cost of each?

3. Draw diagrams, pictures and build models to show the conversion of fuels to heat. Note the by-products. How are they accommodated?

4. Some towns in Scandinavian countries are heated entirely by geothermal heat. What is geothermal heat? Is this system applicable in the United States? If so, where? What other uses could we put geothermal heat to?

5. To get maximum efficiency from a heat generating source, it is necessary to try and store heat. This is accomplished through insulation. What are the major forms of insulation? How are they made? What are they made of? What is the history of man's efforts to insulate his living quarters? What is the future of insulation? What are the cost factors involved in insulation?

6. How is insulation used to store cold as in your refrigerator? The refrigerator is one of the most expensive appliances to run, why? The refrigerator produces heat in the production of cold. Why is this so? How does a refrigerator work?

7. What is a British Thermal Unit, BTU? How is it used in the measurement of heat? What is the difference between temperature and heat?

8. Trace the energy used to heat your home back to its source. What are the conversions it goes through? What are the by- products of its production? What happens to these by-products? Are they efficiently used or misused?

TEACHING TECHNIQUES FOR THE SOCIAL IMPACT OF THE ENERGY CRISIS (CHANGES IN LIFE STYLE)

1. The suburban sprawl is based on the free use of the automobile, and man's ability to live away from his work. Will suburban sprawl stop as a result of the energy crisis? What are the suburban communities in your county? What is their future?

2. Can we maintain our present social structure with limited use of automobiles? List and discuss the social activities which require the use of transportation (i.e., boy scouts, ladies aid, etc.). How far do you travel to get to them? How may they change as a result of restricted travel? Example: fewer meetings, meeting held closer to those effected, etc.

3. What implications does mass transit have as an alternative means of transportation to the automobile. How would your life style change if you had no automobile and had to rely totally on mass transit?

4. Discuss the implications in your life as a result of the Daylight Savings Time being instituted so early in the year (i.e., going to school in the dark, etc.).

5. A three-day workweek has been instituted in some parts of the world to conserve energy. Discuss the social and economic implications in your family, school and community which might take effect if the United States switched to a three-day workweek. What would you do with the extra time? Could you expect the same pay for three days a week?

6. A good means of conserving electricity is watching less television. If your television time were limited, discuss the ways in which you might use the time you normally used to watch television. Would you use more or less energy in these new activities?

7. Car pools are becoming a necessary form of transportation. How would this change the life styles of the people who drive in your family? Would leaving the family car at 'home' possibly put more miles on it? How? Organize a car pool for the teachers in your school.

8. Use of polluting fuels (high sulfur oil or coal) due to a lack of non-polluting fuels (low sulfur oil) may foul the air and water in your community. What are the possibilities of this in your community? Why are some fuels more polluting than others? What do they contain?

9. The Lebanon School District in New Hampshire instituted a four-day school week to conserve energy. Describe the changes in your life style and that of your family if you were only required to go to school four days per week. Example: the need for a babysitter if both parents work; what would you do with the extra time? How would you respond to classroom instruction from the television?

TEACHING TECHNIQUES FOR THE POLITICAL IMPLICATIONS OF THE ENERGY CRISIS

1. Discuss what groups, agencies or governments control the sources of energy, locally, nationally and internationally. How do they exert control?

2. Who should control the sources of energy and how should they be controlled? Are voluntary controls such as lower speed limits or limited use of lights enough, or must the government legislate the restrictions?

3. Compare and contrast the domestic and foreign policies of various nations as they are affected by the energy crisis (i.e., oil embargo, Arab boycott, economic reprisals by non-oil producing countries, etc.).

4. How are the oil producing countries using oil to apply pressure to accomplish their goals? What have been the results?

5. Many emerging nations have 'nationalized' companies on their soil previously owned by the United States or other foreign countries. Does a country have the right to take over a company owned and operated by a foreign country which is inside their territorial limits? Explain your answer.

6. A proposed means of rationing gas is to have the national government give every licensed driver a quantity of ration coupons. They may either use the coupons to buy gas or sell them for whatever price they can get. This is referred to as the 'white market'. Would the government be correct if this policy were instituted? Why? Why not?

7. Another governmental means of controlling gasoline consumption is to place a forty cent per gallon tax on gasoline and institute no rationing. What effect would this have on your family, your community? Would it be fair?

8. Devise a system whereby energy resources might be allocated in the fairest possible manner. Possibility--combination of numbers six and seven.

9. Many states have instituted a policy that allows drivers to buy gas on alternate days by the odd or even numbers on the car's license plate. Do you think this will conserve gas? Why? Why not? Follow the papers and news broadcasts to see how the system is working. Report to the class for current events.

10. List the countries who have the various energy resources (oil, natural gas, coal, etc.), and note their political ideology. What effect does this have on world politics and the availability of resources on the world market?

11. Con Edison has blamed the energy crisis on the environmentalists claiming they are blocking the construction of electric generating plants. Examples are Storm King project on the Hudson River and atomic power plants along the river. Research the issues present here, and have a debate on or role play the conflict.

TEACHING TECHNIQUES FOR THE ECONOMICS OF THE ENERGY CRISIS

1. Research and report on the number of products that are comprised totally or partially of petroleum. Obtain samples of each for display and discussion.

2. The energy crisis directly or indirectly effects prices on stock exchanges throughout the world. Keep a record of selected stock and relate the fluctuations to the energy crisis.

3. Consumer buying can be directly related to the energy crisis. What are the implications for the purchase of a house, a car, appliances, toys, recreational equipment, etc. to the energy crisis? How will you change your buying habits as a result of the energy crisis? How are they related to the use of energy, its supply and cost?

4. Keep a record of supermarket prices. Note the changes and relate this to the energy crisis.

5. Have an electrical utility person show the children what an electric meter is, where it is usually located and how it works.

6. Teach the children how to read the electric meter on their house and keep records of the electricity used.

7. Using the literature published for the appliances in your home and the time spans the appliances consume electricity, calculate the most expensive appliance in your home. (Example: if your television uses 300 watts and runs for 10 hours per day, it consumes three kilowatt hous per day.)

8. What appliances in your home use the most electricity? How might you conserve the energy they use? Can you determine the appliances energy consumption prior to purchasing them? Where would you look? Who could you ask?

9. Discuss the concept of supply and demand. Note that while the supply of oil has gone down, the price of oil has gone up. Why is this true?

10. Con Edison Gas and Electric in New York City has asked for a rate increase which they claim they need due to loss of revenue as a result of the residents of New York City conserving so much electricity. Is this true? If so, why?

11. While the supply of oil is low and the price is high, some oil companies have shown tremendous profits. Explain this.

12. Research the price changes in a barrel of crude oil for the last ten years. Graph your results. What are the future predictions?

13. Research the cost of oil in newspapers and magazines. Are some countries charging more for oil than others? Compare and contrast the differences.

14. Who are the oil producing and oil consuming nations? Locate them on a world map.

15. Have the students research the means by which the various utilities compile the bill you receive for their services. (Example: Central Hudson produces electricity through the burning of oil. Is this cost passed on to you the consumer? If so, how much is it? Note: See Central Hudson rates in index.)

16. To what countries do the oil producing nations sell their crude oil? Are these trade links changing now? Why?

17. What is the oil consumption in barrels per day of the oil consuming nations? Display this on a world map.

18. To what extent does the United States, an oil producing and consuming nation, rely on foreign resources of oil? From what countries and to what extent do we get oil from foreign sources? Graph the results.

19. One claim against gas rationing is that it would create a 'black market' in gasoline. What is a 'black market'? How does it operate?

20. Trace the cost added for product improvement' (each time a product is further processed its price goes up to pay for the man hours and equipment that improved it) and 'profit' for a barrel of crude oil at the well head to the finished product for home heating oil, gasoline, diesel fuel, natural gas, jet fuel and other petroleum related products.

21. In New York City, Con Edison is converting its Ravenswood Generator (Big Alice) back to coal from oil as a source of fuel. Research and discuss the effects of this change, environmental, economic (i.e., storage, transportation and volume of usage of the coal as compared to oil).

22. Who controls the price of fuel oils and the utilities such as gas and electric? What process is used to change the prices?

23. What is a barrel of oil? How much does it contain in gallons or liters?

TEACHING TECHNIQUES FOR THE GEOGRAPHY OF THE ENERGY CRISIS

1. Energy resources (i.e., oil, natural gas, coal, etc.) are located in different geographic regions of the world. Research the known resources and indicate their location on a world map.

2. List the countries which have the various energy resources, and to what extent they possess each.

3. Research and discuss the process of strip mining coal. Use films, newspapers, etc. Can the land be reclaimed? If more reliance is placed on coal as an energy resource, should restrictions on strip mining be lifted? Why? Why not?

4. A possible source of oil has been discovered in oil shale. Up until now, this source of oil has not been economical. How will the oil be extracted? Where are these deposits of oil shale? How long will it take to develop them? Why is this source of energy now economical?

5. Many of our oil resources are found under the ocean floor. Draw a map indicating where our present offshore resources are located. Where might new sources be found?

6. Research the process of offshore drilling for oil in terms of time, materials, men, cost per well and architecture of the platform. Build a model or use a wall mural to show the process.

7. Offshore oil drilling was stopped in the bay off Santa Barbara because of an oil spillage problem. In light of the energy crisis, will Santa Barbara now allow oil companies to resume drilling in the bay? Have the children take sides and debate on or role play the issue.

8. What are the geographical characteristics that indicate a possible oil, oil shale, coal or natural gas reserve.

TEACHING TECHNIQUES FOR THE ENERGY OF TRANSPORTATION

1. Our society is based on the extensive use of the automobile. What are the differences in the types of fuel used in the automobile (regular, high test)? Why are some more expensive than others?

2. Research and explore the development of the internal combustion engine.

3. Research and explore the development of the steam engine.

4. Through the use of diagrams, drawings and models, compare and contrast the internal combustion engine and the diesel engine.

5. Through the use of diagrams, drawings and models, demonstrate the differences between the internal combustion engine, the rotary engine (wankel engine) and the gas turbine engine as they relate to energy conversion and the by-products produced.

6. Relate the cost per gallon of diesel fuel to gasoline. Why the differences? Have a representative of a fuel company talk to the class.

7. Through the use of drawings and charts, demonstrate the conversion of energy from fossil fuel (gasoline) to the mechanical energy which drives the rear wheels of the car.

8. Research and explore the conversion of fossil fuel energy through a ship's engine to the propeller.

9. Through the use of charts, diagrams and models, explain the conversion of energy through the jet engine. Explore the uses of the jet engine in transportation.

10. Compare and contrast the differences in the various conversion devices used in transportation as they relate to cost of fuel, the efficiency of the device and the usability of the device.

11. Compare and contrast various costs (i.e., dollars per mile, dollars per hour and dollars per pound for transporting goods-- i.e., Is it more expensive dollar wise to transport materials on land, sea or air?) (Two means of transportation on land are railroads and highways.) What are the advantages--disadvantages?

12. Build or draw a model of a steam railroad engine. What are the fuel alternatives? Build a model of an electric railroad engine. Trace the energy flow through the engines.

13. Research and explore cost per mile for the fuel used in each means of transportation. (Example: write to the major railroads and ask the cost to run a steam, diesel and electric engine one mile.)

14. Compare and contrast different means of transportation as they relate to individuals (i.e., usability, access to, comfort, time required to use, etc.). (Example: mass transportation uses less energy per person carried, but each person carried may pay more than if the private automobile was used. An airplane uses a lot of energy, but is much faster than an automobile.)

15. What are the major means of transportation in your community (cars, buses, trains, planes)? Visit a bus station and examine the schedule and the routes the buses take, their origin and destination. Interview a reservation clerk. Are more people using the bus now than one year ago? Board a bus, examine the facilities and conveniences offered. Compare and contrast this to the train and private automobile. Calculate the cost per person per mile transported in a car, bus, train, ship or airplane.

16. Visit a railroad or have a representative come to the class. Examine the different means of railroad transportation. Examine the differences between passenger and freight lines. Examine the different forms of energy used in railroad transportation (i.e., diesel fuel, coal, steam and electricity).

17. Visit an airport or see films about airports. Observe the different fuels used by the aircraft. Examine different types of aircraft. Observe the fueling operations. Research fuel consumption on various types of aircraft. How many gallons of gasoline are required for an hour's flight? How much does this cost?

18. Compare the energy expended in foot pounds for the following means of transportation: walking, riding a bicycle, used in an automobile, used in an airplane over the same distance. Compare the time involved in each one of these and the costs.

19. Interview the transportation supervisor or building principal and obtain or compute the following information:

    a. the number of miles each school bus goes per day.
    b. the number of gallons each bus uses each day.
    c. divide the miles by the gallons to get the miles per gallon for each bus per day.

20. Obtain a road map of the area and indicate the bus runs, and put pins where each child lives. Use geodetic (contour) maps which can be purchased in major stationery stores.

21. Try to formulate more efficient bus runs; that is pick up more children with one bus. Remember, you have to get them all to school on time.

TEACHING TECHNIQUES FOR THE ENERGY IN THE HOME

1. Locate and name the different forms of energy used in your home. How does the energy get to your home? Do you store it? Where? Show this on a bulletin board.

2. How does your family heat your home? What type of fuel is used? Make a chart or diagram showing the heating system in your home, (i.e., hot water, steam, hot air, electricity). Discuss the conversion device used to convert fuel into heat.

3. How many electrical appliances does your home have? Keep records to show which ones are used most often. Which ones could you do without or use a manual substitute? (Example - a manual can opener.) Which appliances or machines are operated by manual switches, and which are operated by automatic switches? (Example - a radio has a manual switch, a refrigerator is turned on and off automatically.) Relate this to energy use and conservation.

4. Of what materials is your home constructed? How is your home insulated? Make a chart or a drawing describing the insulation used in your home.

5. Contact Central Hudson and ask for someone to come and teach the children how to read gas and electric meters. Keep records of the energy used over various time periods.

6. How much money is spent per year to heat your home? How much money is spent per year for electricity in your home? Compare your findings with your friends. Why are there differences?

7. How do most of the families in your community heat their homes? Call the energy surplus suppliers, and ask how many customers they have.

8. Inspect your home for areas in which heat loss might be stopped (i.e., installation of weather stripping around doors and windows or caulking around doors and windows, added insulation in the ceiling and the use of storm windows and doors).

9. Call or visit a fuel oil distributor with the dimensions of your house. Ask how many BTU's are required to heat your home, and the most efficient means to obtain this heat. The fuel oil distributor has formulas for different heating requirements. Ask a fuel oil representative to visit your class and demonstrate the use of these formulas.

10. Research and discuss reasons why after installing a heating system in their cellar, a family found that their heating bill for that year was no more than the heating bill for the previous year when there was no heat in the cellar. Explain this.

11. Identify electrical appliances and non-electrical or mechanical counterparts. (Examples: can opener, hedge sheers, toothbrush, clothes dryer, mix master, washing machine, hair dryer, typewriter, phonograph, scissors.)

12. Some buildings are designed with heating systems that operate efficiently with the lights left on. Why is this true?

13. Set thermometers at different locations about your home; record the temperatures at the same time. Explain your findings in terms of heat efficiency, comfort, etc.

14. Contact the local utility or home contractor, identify the cost per cubic foot to heat with electricity, gas, oil and coal. (Figure may not be available for coal.)

15. Interview someone who heats or has heated their home with coal. Discuss costs, transportation and storage of the coal, how the system functions and ask the children if they would like to use coal to heat their home. Have some coal and cinders available to show what coal looks like before and after burning. Discuss the use of the by-product cinders.

TEACHING TECHNIQUES FOR THE ENERGY IN THE SCHOOL

1. Visit the custodian and ask what types of energy are used in your school. Make a bulletin board to show the types of energy used in your school, how it gets there and where it is stored.

2. Visit the heating facility in your school. Describe its operation, the conversion of energy and transmission of heat. Examine the electrical equipment in your school. How much energy does your school consume in gallons, kilowatts, etc.?

3. Show the children how to read a thermometer--Fahrenheit and Centigrade.

4. What is the temperature in your classroom? Set thermometers around the room or building. Record the temperatures at various times. With this information, discuss the efficiency of the heating system in your classroom or school (i.e., are some locations within the room colder than others? Are some rooms colder than others? Is the hallway colder than rooms, etc.?) How might these inconsistencies be corrected? Should they be?

5. What is the temperature of your school at night or on weekends? Below a given temperature it will require more energy to warm the building up than it would be to maintain a slightly higher temperature continuously. What is this temperature in your building? Consult your custodian or fuel oil supplier.

6. Have you changed your clothing or dress patterns to accommodate lower temperatures in your school and home? If so, how? Have you become accustomed to these lower temperatures? Make a bulletin board to show the warmer clothes. Discuss the way clothes keep you warm, and why some work better than others.

7. Has your school lowered its temperatures to comply with the energy crisis in an effort to conserve energy? Ask the custodian what energy conservation measures are being taken in your school.

8. What is the history of the heating system in your school? If it has changed, discuss the reasons for the change.

9. Is there now a possibility that your school might change its means of heating in the future? What are the alternative conversion devices and sources of fuel? Would they be more expensive or less expensive than the one used now? Consult your custodian.

10. What is the requirement in foot candles for lighting your school and home adequately? Obtain a light meter, and check the foot candles of light emanating at different areas in your home and school. If they are incorrect, too much light or too little light, what steps can you take to correct them? (See conservation tips for foot candle requirements.)

TEACHING TECHNIQUES FOR THE ENERGY IN THE COMMUNITY

1. Based on a map of your community, locate the largest energy users in your community. Place the map on the wall and pin the names of the companies or utilities on the map.

2. Using a map, trace the flow of energy in and out of your community.

3. What kinds of fuels are used in your community? How much fuel is used? What does it cost per year? Make graphs, tables and charts to show the energy used in your community.

4. Visit your local town planning board or town council. What are their plans for energy use and conservation, short and long range?

5. Relate the energy used in your town to its transportation, storage and utilization.

6. Discuss and report the utilization of energy by the major utilities in your town (i.e., water department, natural gas and electricity, telephone company, etc.).

7. Visit (have representatives talk to the class) the large energy users such as factories and industries in your town. Discuss the use of energy by these companies or factories with their owners. What measures, if any, have they taken to conserve energy?

8. Have a service station attendant visit your school and discuss his facility. Discuss the energy sources he provides, how they get there, where they are stored, and how he allocates them to the public.

9. Role play the frustrations people might face as a result of the gas shortage (i.e., leaving for work earlier, traffic jams, etc.).

10. What industries or businesses in your community are suffering because of the energy crisis? (Example - restaurants, ski resorts, theaters, etc.)

11. What industries or businesses in your community are not effected by the energy crisis?

12. List the agencies or organizations in your community that should not be effected. (Example-hospitals, police, fire department, ambulance service, etc.)

PROJECTS RELATED TO THE ENERGY CRISIS AND ENERGY CONSERVATION

1. Student plays--(i.e., The Day the Sun Went Out, The Day the Oil Delivery Didn't Arrive, Life Without Automobiles, etc.).

2. Energy Conservation Drive--a contest to devise an efficient comprehensive list of energy conservation activities for the home and school.

3. Poster Contest--themes would include Energy Conservation, The Efficient Use of Electrical Appliances, How to Conserve Heat, etc.

4. An essay contest on energy conservation--themes could revolve around energy itself, uses, conversion and conservation.

5. Public surveys about the energy crisis--how does the public feel about cutting back on the use of heat, gasoline, electricity, etc.? Develop a questionnaire, compile the results and give it to the local newspaper.

6. *Interview public officials about energy use and conservation. What are their plans for the future?*

7. Assembly programs using films, guest speakers, student plays, etc. to demonstrate various forms of energy conversion, utilization, consumption.

8. Use charts, models tables, diagrams, wall murals, etc. to demonstrate various areas of energy.

9. Develop school mottos, themes, animated mascots, etc. to demonstrate the energy crisis.

10. The formation of a club, group or organization in your school or classroom which would act as an energy conservation committee. They would monitor the energy consumed in the school through heating and electricity, and meet with the principal and/or custodian to discuss these findings.

11. Develop scrap books of charts based on articles and periodicals based on the energy crisis--local, national and international.

12. Projects relating to how plants and animals convert energy. This could be accomplished through charts, tables, reports, panel discussion, diagrams, etc. A bulletin board display of energy conversion as it relates to plants and animals.

13. Do it yourself blackout. Have the children experience the feeling of being without lights through darkened rooms, etc.

14. Overall energy conservation campaign in the school through posters, buttons, slogans, contests, displays, assemblies, etc.

15. Have children examine as many different kinds of fuels as possible through sight, touch, smell, etc. (Examples - Assemble a display of fuel oil, kerosene, gasoline, coal, uranium, natural gas.)

16. Oil and its uses--form committees or groups to ascertain as many possible uses of petroleum or crude oil as possible. Research and discuss the changes that the crude oil goes through before it reaches the form used by the consumer.

17. Examine various kinds of insulation. Build and test models with the use of thermometers, etc.

18. Place one thermometer in the sun and one thermometer close to it, but not in the sun. Note the temperature change. Discuss the 'Greenhouse Effect' or 'Solar Gain .

19. Place two boxes in the sun--one white and one black. Place a thermometer in each. Record the differences in temperature. Relate this to home heating requirements.

20. Place thermometers outside--one in the snow, one in the air, and one against the building. Note the readings--explain the differences, if any.

21. Obtain two glass soda bottles. Place equal sized balloons over the openings of each. Place one in the sun and one in an area of the same room not lighted by the sun. Note and record differences. Discuss reasons for differences. What is the energy source?

22. Compose a song or write poems about energy conservation, the types of energy used in your home or school or about an animated mascot representing energy conservation.

ENERGY CONSERVATION

We, in the United States, while representing only one-sixth of the world's population, are using two-thirds of the world's energy resources. Energy consumption can be expected to double in ten years at the present rate. Conservation must become more than a by-word or motto if our society as we know it is to survive. It must become part of our everyday lives. There are several ways which students can explore alternatives to conserve energy.

1. Restrict the Use of Energy. Have the students form groups or task forces to canvass their home and their school building and advise ways to limit the use of all kinds of energy.

2. Improve Efficiency. Getting more work out for the same input of energy. For example, have children check the differences in miles per gallon on automobiles which are properly tuned against those which are improperly tuned. Tips for improving efficiency are contained at the back of this booklet, along with resources which may yield additional assistance.

3. Use a Different Conversion Device of an Alternative Form of Energy. For example, use flourescent lights rather than incandescent lights. The human body is an alternative conversion device that can save energy. It can do many things that machines do. It can generate heat, provide transportation, manufacture goods and may reclaim jobs formally done by machines, such as washing dishes. Explore the use of nuclear energy as an alternative to fossil fuel.

ENERGY CONSERVATION TIPS

The following tips for the conservation of energy are presented to aid the student in taking an active role in conserving enerav:

I. Conserving Electricity

A. Lighting

1. Turn off all lights when they are not needed or when you are out of the office, classroom or over weekends.

2. Avoid the use of strictly decorative lighting.

3. Try to utilize flourescent lamps where possible. They provide up to four times as much light as comparable incandescent lamp. Be conscious of efficiency in lighting.

   Obtain a light meter and take brightness readings. Reduce the lighting to the adequate amount. Lamps are labeled lumens as well as watts. Minimum State Education Department requirements for lighting in the public schools are:

   ten foot candles--maintained in auditorium, corridors, locker rooms and lavatories.

   twenty foot candles--maintained in cafeteria and gym.

   thirty foot candles--maintained in classrooms, study halls, library, offices and shops.

   forty foot candles--maintained in rooms where fine detail work is to be done.

4. Reduce the 'on time' of all night secruity lighting or reduce quantity where possible.

5. Turn off lights in areas where windows give adequate illumination.

6. Turn off supplemental lights in shops and labs where not necessary.

7. Shut down all electrical equipment when not in use.

8. Use long life incandescent lamps only in fixtures which are difficult to relamp.

B. Appliances

1. Use hand appliances instead of electric wherever possible.

2. Do not use kitchen range or stove for room heating purposes. It is dangerous and still uses energy, perhaps more.

3. When using the stove, either gas or electric, choose a burner that corresponds to the size of the pan.

4. Make the oven, either gas or electric, do double duty by using it to cook more than one item at a time.

5. Turn off the oven 15 minutes early and use the stored heat to finish cooking.

6. Limit TV viewing. Turn off set when leaving room. If set has the 'instant on picture' quality, this usually indicates some tubes are burning continuously, so pull the plug and plug in the set only for viewing time.

7. Do not use radio or stereo merely for background music.

8. If there is a brown out in your community, use as few appliances as possible as the reduced voltage causes electric motors to work harder and they will need repair sooner. An indication of a reduction of voltage in your home is a corresponding reduction in the size of the picture on your television. Call the power company to find out for sure.

II. <u>Home Heating</u>

A. Set thermometers in various places throughout the room and/or house. Check for the efficiency of the heating system by comparing the various temperatures. Develop a means to rid the room or house of unwanted fluctuations in temperatures.

B. Lower thermostats to a setting of 68 degrees Fahrenheit during hours the room is used. Lower to 60 degrees Fahrenheit when room is not in use or at night.

C. Allow as much sunlight as possible to enter the room to enhance 'solar gain'.

D. On cloudy days, close drapes or venetian blinds as they help to insulate the room.

E. Reduce heat supplied to unoccupied spaces such as stairwells, storage rooms and corridors.

F. Increase the level of relative humidity. The ideal settings are between 40 and 60 percent.

G. Inspect the insulation of walls and ceilings where possible. Also inspect weather stripping, caulking and storm windows for proper installation and operation. Install additional insulation where needed.

H. Inspect pipes carrying hot water through unheated spaces. These pipes should be insulated.

I. Keep obstructions away from vents or radiators to allow free flow of heat.

III. Hot Water

A. Reduce thermostat to 110 degrees Fahrenheit for washroom use or eliminate hot water entirely.

B. Reduce thermostats for hot water used for dishwashing to minimum temperatures allowable by public health codes.

C. Inspect all faucets for leaks; repair where necessary.

D. Insulate pipes carrying hot water.

IV. Gasoline

A. Reduce warmup time. Car will warm up more efficiently while driving.

B. Do not leave the car idle if you are going to be gone for more than three minutes.

C. Do not allow fuel supply in the gas tank to get lower than ¼ tank. Sludge and deposits will be transmitted to the engine and cause poor operation.

D. Drive with a smooth and easy acceleration and deceleration or as if there were a raw egg between your foot and the accelerator.

E. Keep your car properly tuned.

F. Where possible, use radial tires.

G. When purchasing an automobile, beware of expensive fuel consuming accessories such as air conditioning, power steering, etc.

H. Six cylinder engines are usually more efficient than eight cylinder engines.

I. Eliminate all unncessary trips where possible. Combine as many trips as possible into one.

J. Form car pools or use mass transportation where feasible.

K. Maintain adequate air pressure in your tires.

L. Observe speed limits.

M. Reduce field trips wherever possible.

GLOSSARY

BLACKOUT - The loss of all electrical energy to a given geographic area.

BRITISH THERMAL UNIT (BTU) - A measurement of heat production. This is the amount of heat required to raise one pound of water one degree Fahrenheit. One BTU = 252 calories.

BROWNOUT - The reduction of voltage (electrical energy) in a given geographic area.

BY-PRODUCT - That which is produced as a side effect of energy conversion. (Example - The conversion of the energy in fuel to electrical energy produces the by-products of heat, smoke, odors, etc.)

CALORIE - The amount of heat required to raise one gram of water one degree Centigrade. One BTU = 252 calories.

CANDLE POWER - The light emitting quality of a light source as compared with a standard candle.

CAULKING - A puddy-like substance used to fill holes and cracks around doors and windows.

CENTIGRADE DEGREE - A measurement of heat where water boils at 100 degrees and freezes at 0 degrees and the normal temperature of the body is 37 degrees.

CENTRAL HUDSON - rate scale

0-24 kw hours	3.04¢
25-120 kw hours	5.39¢
121-156 kw hours	3.35¢
157-180 kw hours	2.03¢
180+ kw hours	1.83¢

Note: Add to this the current fuel allowance (cost of the fuel needed to produce the electricity) which changes with every billing. Example: $4.00 per 1,000 kw, January 1974, $9.20 per 1,000 kw, March 1974.

CONVERSION DEVICE - That which converts energy from one form to another.

EFFICIENCY - The degree to which a function is performed in the best possible manner.

ENERGY - The ability to do work.

FAHRENHEIT DEGREE - A measurement of heat where water boils at 212 degrees and freezes at 32 degrees.

FISSION - The release of energy through the splitting of an atom.

FOSSIL FUEL - A fuel which is comprised of organic materials.

FOOT CANDLE - The intensity of illumination on a surface perpendicular to a beam of light one foot away.

FUSION - The unity of atoms and the release of energy.

GEOTHERMAL ENERGY - Heat energy derived from the heat stored beneath the surface of the earth, usually presented in the form of steam.

HEAT - A form of energy produced as a result of work. One BTU = 778 foot pounds.

INSULATION - Materials used to isolate and maintain a given temperature.

KINETIC ENERGY - Energy in motion. As an object falls its speed increases and the potential energy it had to begin with is converted into kinetic energy. The kinetic energy of the wind exerts a force causing a windmill to turn.

NUCLEAR ENERGY - The energy released through fusion or fission.

POTENTIAL ENERGY - Stored energy. An object raised to a given elevation has potential energy which will be released as it falls. Water stored behind a dam has potential energy.

POWER - The rate at which work is done. Power = work divided by time.

SOLAR GAIN - The energy from the sun striking an object and being converted into heat energy.

TEMPERATURE - An indication of molecular motion. As heat is added to a substance, the materials move about faster and this substance expands. Hence, the liquid in a thermometer occupies more room within its container and we say the temperature goes up.

WATT - Basic measurement of electrical power. One watt = .73 foot pounds per second or .00134 horsepower. One kilowatt (kw) = 1,000 watts.

WORK - A force moving a given distance. Work = force times distance measured in foot pounds.

ADDITIONAL RESOURCES

Local

Central Hudson Gas and Electric Corporation
284 South Avenue
Poughkeepsie, New York 12602

Chamber of Commerce
80 Washington Street
Poughkeepsie, New York 12600

Dutchess County Cooperative Extension
Millbrook, New York 12454
677-8200

Mrs. Joseph Lombardy
Dutchess County Environmental Association
9 Greenfield Road
Poughkeepsie, New York 12602
452-7749

Local Oil Distributors

Local Petroleum Distributors (i.e., Exxon, Mobil, Texaco)

Mr. Richard Lauria
Civil Defense Director
Nelson House Annex
Poughkeepsie, New York 12601

State

Mr. John Edwards
Energy Fuel and Supplies Analysis
Public Services Commission
44 Holland Avenue
Albany, New York 12208
(518) 474-8313

Educational Facilities Lab
477 Madison Avenue
New York, New York 10022

New York State Publications
University of the State of New York
State Education Department
Albany, New York 12224

New York State Department of Environmental Conservation
South Puttcorners Road
New Paltz, New York 12561
255-5453

'Educational Institutions Guidelines'
University of the State of New York
State Education Department
Albany, New York 12224

New York State Cooperative Extension
Farm and Home Center
Millbrook, New York 12545
677-8200

New York State Environmental
Department of Environmental Conservation
South Wolff Road
Albany, New York 12224
(518) 457-5676

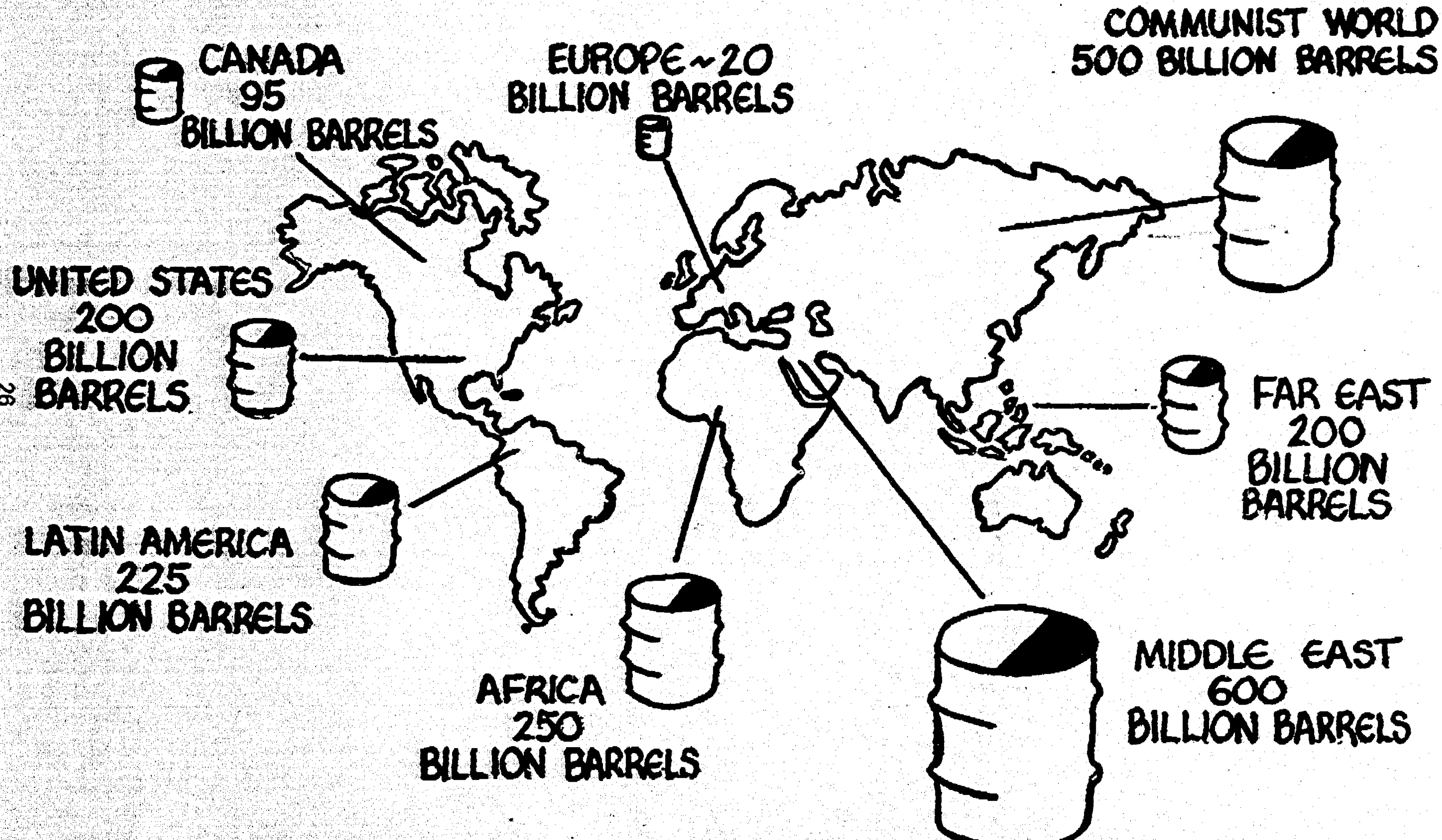
Federal

U.S. Printing Office
North Capital Street NW
Washington, D.C. 20402

Mr. Gerald Turetsky
Federal Energy Commissioner
26 Federal Plaza
New York, New York 10007

The Environmental Protection Agency
401 M Street, SW
Washington, D.C. 20024

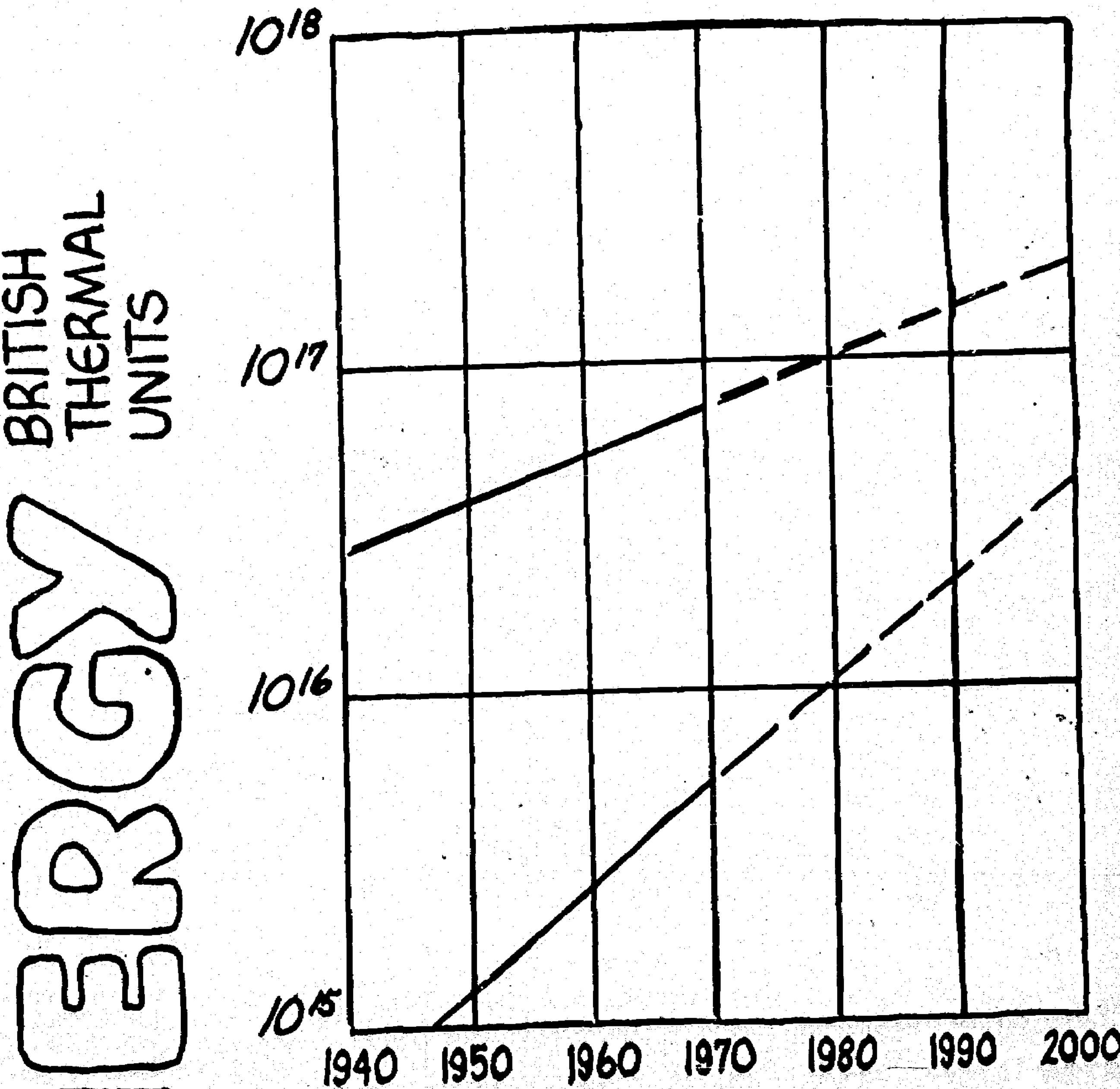
THE SEARCH GOES ON...



THIS CHART REPRESENTS ULTIMATE CRUDE-OIL PRODUCTION, INCLUDING OIL FROM OFFSHORE AREAS, OIL ALREADY PRODUCED, PROVED AND PROBABLE RESERVES, AND FUTURE DISCOVERIES.

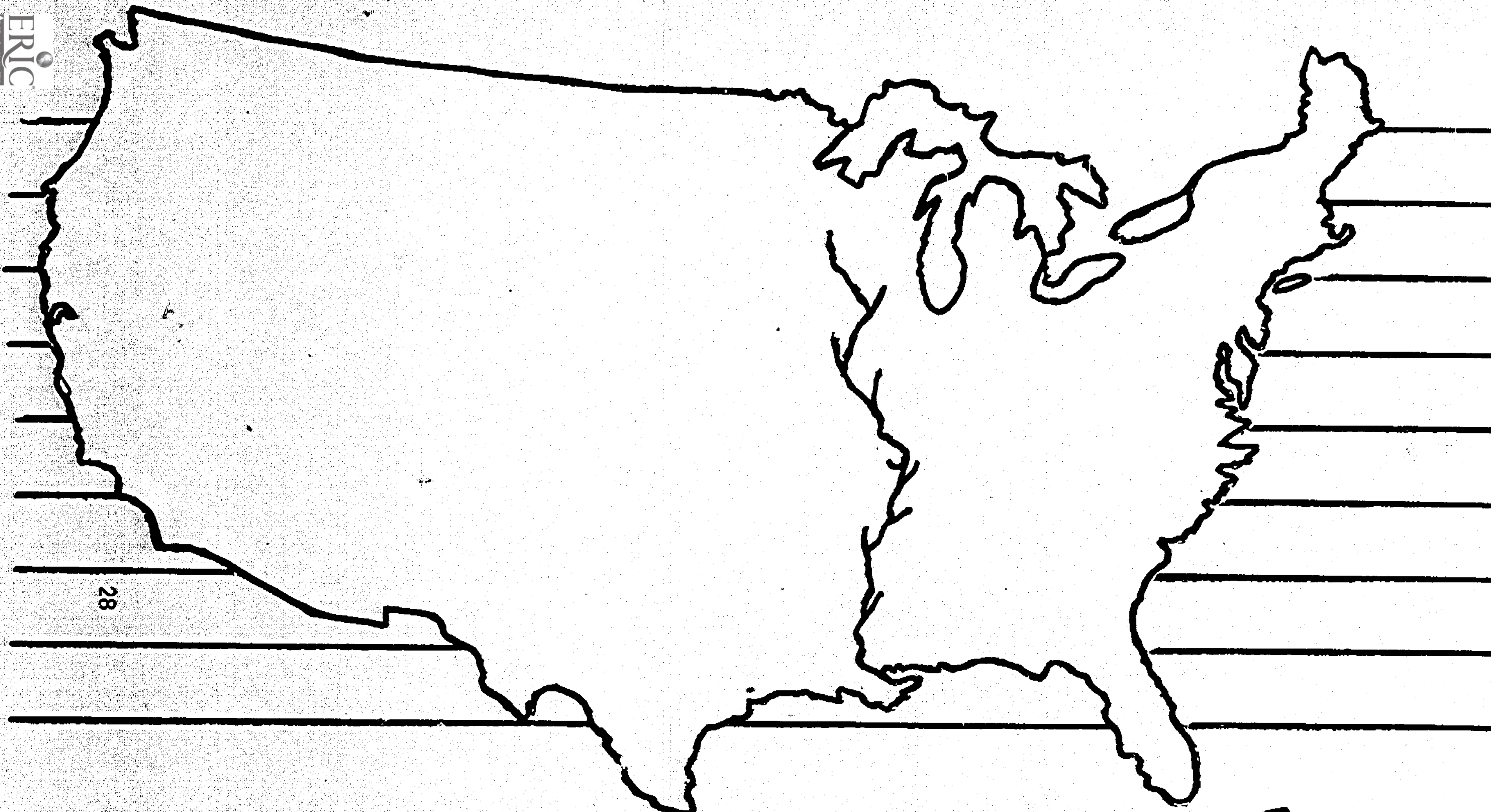
Energy Man's Alternatives, Buffalo Public Schools, Division of Instructional Services, Buffalo, New York 1973.

ENERGY



ACCELERATING TREND TOWARD AN "ALL ELECTRIC" ECONOMY IS EVIDENT IN THIS GRAPH...
TOP LINE ~ OVERALL ENERGY DEMAND
BOTTOM LINE ~ ELECTRICITY DEMAND

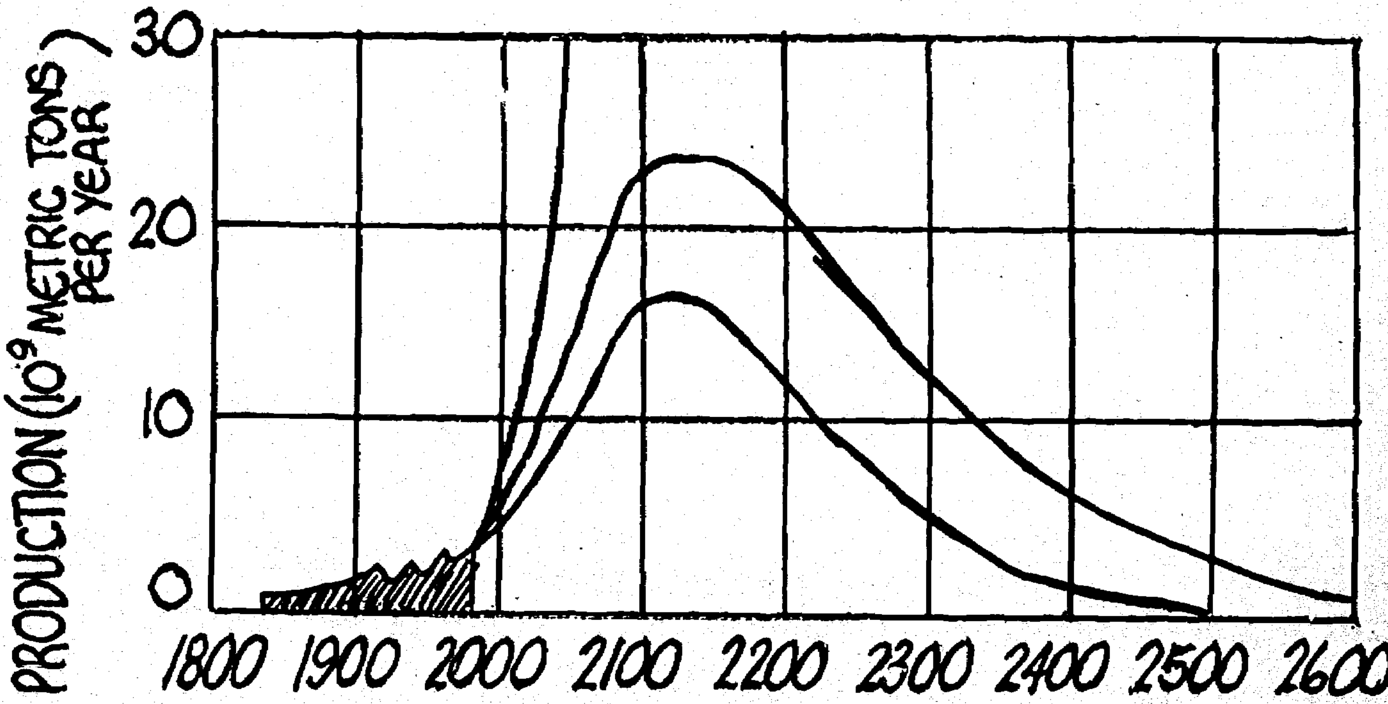
<u>Energy Man's Alternatives</u>, Buffalo Public Schools, Division of Instructional Services, Buffalo, New York 1973.



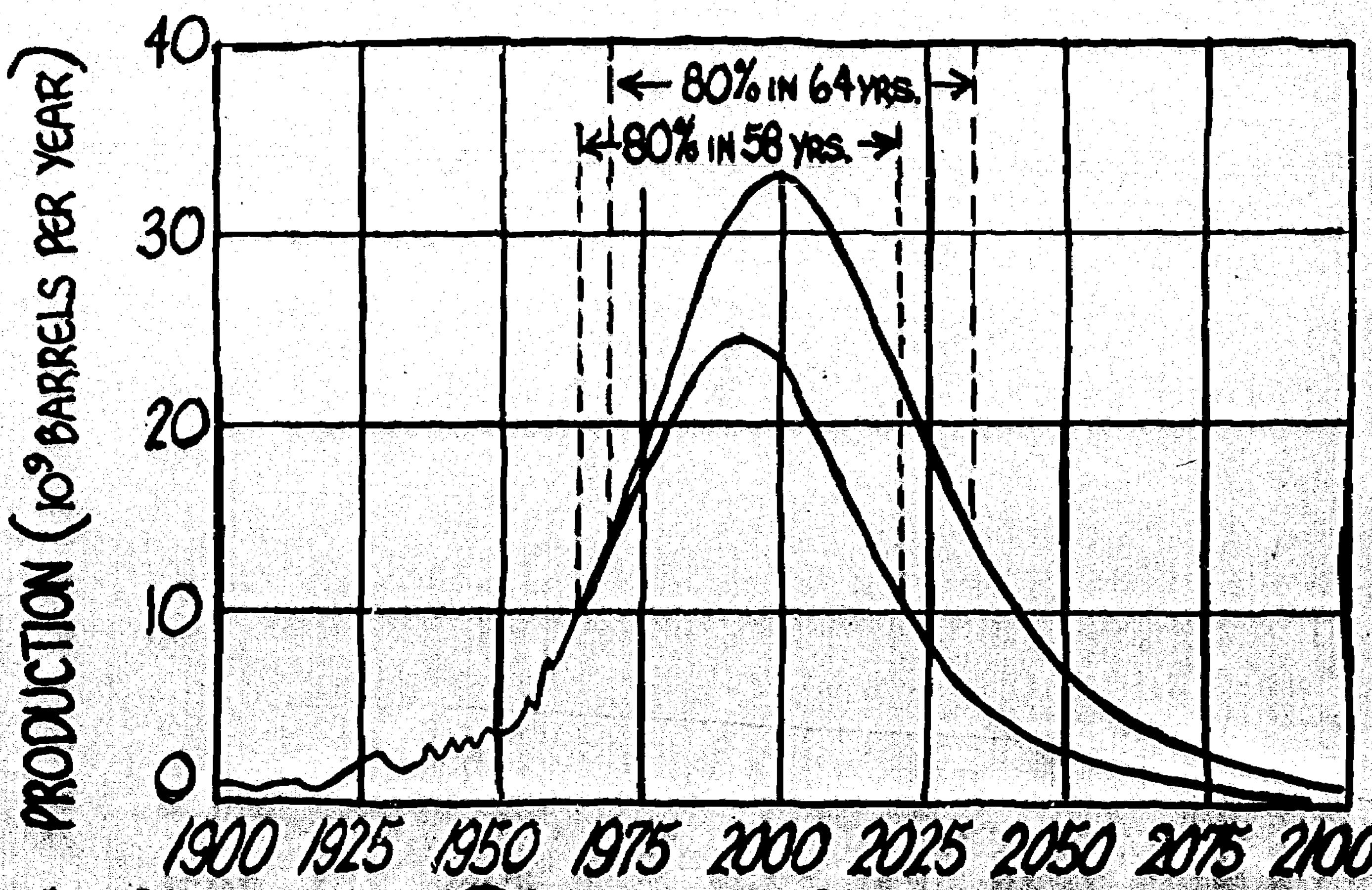
THE NATION'S RESOURCES!

- ☐ COAL FIELDS
- ☐ OIL FIELDS
- ☐ GAS FIELDS
- ☐ IRON ORE
- ☐ NUCLEAR FUELS
- ☐ DAMS

Energy Man's Alternatives, Buffalo Public Schools, Division of Instructional Services, Buffalo, New York 1973.

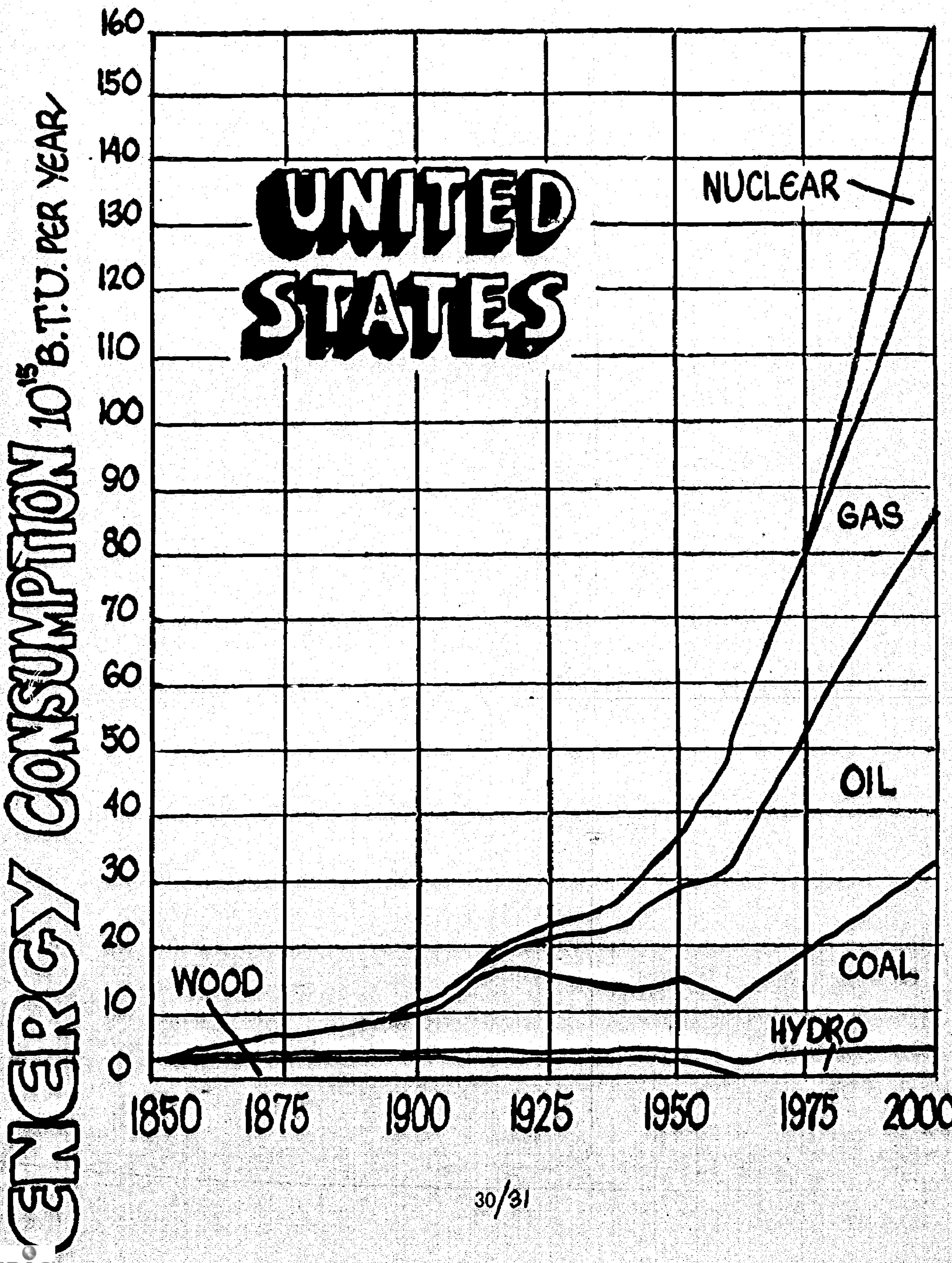


CYCLE OF WORLD COAL PRODUCTION



CYCLE OF WORLD OIL PRODUCTION

Man's Alternatives, Buffalo Public Schools, Div. of Instructional Serv., Buffalo, NY 197



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